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NEO PERSONALITY INVENTORY-REVISED NORMATIVE DATA THAT DISTINGUISH U.S. AIR FORCE AC-130 GUNSHIP SENSOR OPERATORS FROM ENLISTED AIRMEN WHO FAIL TRAINING AND PEERS IN THE GENERAL POPULATION

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14. ABSTRACT

United States Air Force (USAF) AC-130 gunship sensor operators (SOs) represent a unique group of enlisted airmen in a high-demand, high-risk position where they have a central role in reconnaissance, surveillance, and aerial precision-strike operations in combat. Although there is research on the influence and role of personality traits regarding USAF pilots and other high-demand, high-risk aviation-related military positions, there has been much less focus on the personality traits of AC-130 gunship SOs. To fill the gap in the literature, the NEO Personality Inventory-Revised (NEO PI-R) was administered to enlisted airmen who had successfully passed training (n = 59) as well as failed training (n = 20) in an effort to (a) assess how the personality traits of such a specialized group of enlisted airmen (SO incumbents) differ from the civilian general population, (b) assess how key personality traits (e.g., neuroticism, extraversion, openness, agreeableness, conscientiousness) for incumbents differ from enlisted airmen who failed training, (c) develop occupationally specific normative data and distribution of personality scores for use in aeromedical clinical psychological evaluations, and (d) illustrate the value of using occupationally specific normative data and cutoff values regarding personality test scores to improve the selection of future candidates who have a greater probability of success in training. Results assist military and civilian clinical psychologists with the interpretation of NEO PI-R psychological test scores for SO applicants and incumbents and inform decision makers on personality traits that may be useful in the selection process for this career field.

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1.0 EXECUTIVE SUMMARY

United States Air Force (USAF) AC-130 gunship sensor operators (SOs) represent a unique group of enlisted airmen in a high-demand, high-risk position where they have a central role in reconnaissance, surveillance, and aerial precision-strike operations in combat. Because of the demanding nature of SO duties, the cost of acquiring and training a single SO applicant in terms of manpower, material, time, and money is high and estimated at $1 million a year based upon discussion with training pipeline managers. Although there is research on the influence and role of personality traits regarding USAF pilots and other high-demand, high-risk, aviation-related military positions, there has been much less focus on the personality traits of AC-130 gunship SOs. Although personality assessment is a key part of the selection and processing of applicants and the aeromedical waiver process for incumbents, there is limited research on the traits that distinguish those who succeed in this demanding career field. To fill the gap in the literature, the NEO Personality Inventory-Revised (NEO PI-R) was administered to enlisted airmen who had successfully passed training (n = 59) as well as failed training (n = 20) in an effort to (a) assess how the personality traits of such a specialized group of enlisted airmen (SO incumbents) differ from the civilian general population, (b) assess how key personality traits (e.g., neuroticism, extraversion, openness, agreeableness, conscientiousness) for incumbents differ from enlisted airmen who failed training, (c) develop occupationally specific normative data and distribution of personality scores for use in aeromedical clinical psychological evaluations, and (d) illustrate the value of using test scores on personality traits to improve the selection of future candidates who have a greater probability of success in training. Results assist military and civilian clinical psychologists with the interpretation of NEO PI-R psychological test scores for SO applicants and incumbents and inform decision makers on personality traits that may be useful in the selection process for this career field.

2.0 INTRODUCTION

United States Air Force (USAF) AC-130 gunship sensor operators (SOs) represent a group of enlisted airmen in a high-demand, high-risk, aviation-related position where they have a pivotal role in precision-strike aerial operations. Subject matter experts (SMEs) report this position requires enlisted airmen to possess a special set of skills and traits (Chappelle WL, Patterson J, Sowin T, Randall B, *Critical Psychological Attributes of U.S. Air Force AC-130 Gunship Sensor Operators According to Subject Matter Experts*, AFRL-SA-BR-TR-2009-0015, Feb 2009; available through the Defense Technical Information Center to Department of Defense and U.S. DoD contractors only). Specifically, high levels of emotional resilience, confidence, discipline, motivation, and interest in military operations have been reported by SMEs as critical to performance. It has been well established that personality traits can impact job performance, retention, and satisfaction (Ref 1-5). In particular, the identification of specific personality traits often adds to the incremental validity of personnel selection practices (Ref 6,7) and is considered critical to the selection of U.S. military personnel in high-demand, high-risk duty positions (Ref 8). The identification of key attributes (e.g., personality traits) that distinguish enlisted airmen for AC-130 gunship SO duties is crucial to aeromedical and recruitment agencies responsible for the sustainment and performance of those selected for such a high-demand, high-risk career field. However, the only published study regarding objective psychological testing of gunship SOs examined cognitive ability and aptitudes (Ref 9). As a result, the knowledge and

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research on normative personality traits of such a highly specialized aviation-related career field are limited.

To fill the gap in the literature, this study evaluated psychological baseline test scores from the NEO Personality Inventory-Revised (NEO PI-R) on enlisted airmen who successfully passed AC-130 gunship SO training as well as those who failed in an effort to (a) obtain normative personality testing on SO incumbents to assess how the personality traits of such a specialized group of enlisted airmen differ from the civilian, nonaircrew general population; (b) assess how key personality traits (e.g., neuroticism, extraversion, openness, agreeableness, conscientiousness) for incumbents differ from enlisted airmen who failed training; (c) develop occupationally specific normative data and distribution of personality scores for use in aeromedical evaluations; and (d) illustrate the value of using test scores on personality traits to improve the selection of future candidates who have a greater probability of success in training. Assessing for critical differences in the personality traits that distinguish gunship SOs from the general population and those who fail training may help improve the aeromedical evaluations of training candidates and SO incumbents.

The results of the study aim to shed light on objective personality traits and differences and assist military psychologists with the interpretation of NEO PI-R psychological test scores when evaluating the suitability and fitness of training applicants and incumbents. The results of the study provide psychologists with valuable information to improve their acumen when interpreting tests that assess various facets of personality (e.g., neuroticism, extraversion, openness, agreeableness, and conscientiousness) of those airmen who become AC-130 gunship SOs. A case vignette is provided to illustrate application of study findings.

2.1 Role and Aircrew of the AC-130 Gunship

Over the past 40 years, the AC-130 gunship has been instrumental in supporting combat-related operations. Following the Vietnam War, SOs served as a critical part of the gunship aircrew in providing air base defense and close air support in Operations Desert Storm (Iraq), Continue Hope (Somalia), United Shield (Somalia), and Just Cause (Panama). More recently, AC-130 gunship SOs have provided force protection, armed reconnaissance, air interdiction, and air support of ground troops fighting in Iraq (Operation Iraqi Freedom) and Afghanistan (Operation Enduring Freedom). Because of the unique capabilities such an airframe provides and its role in supporting joint special operations, its capabilities will likely continue to be relied upon throughout current and future conflicts.

The AC-130 gunship has a crew of several military personnel composed of commissioned officers (i.e., a pilot, co-pilot, navigator, fire control officer, and electronic warfare officer) and enlisted personnel (i.e., a flight engineer, loadmaster, SO, infrared detection sensor operator, and aerial gunners). Although each officer and enlisted crew position is instrumental to successful mission performance, there is growing attention on the SO's role because of the requirements of this position for identifying and targeting enemy combatants and resources through imagery analysis and electronic weaponry. The SO has a critical role, and without such a crew position, the reconnaissance and force protection capabilities of AC-130 gunships are significantly limited. As a result, command and medical leaderships (see citation on page 1 for Chappelle et al., 2009) often conclude the duty position of a SO is best suited for military personnel with a unique set of psychological attributes (e.g., cognitive/psychomotor ability, emotional stability, interpersonal traits, and motivation).

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2.2 Duties and Role of the AC-130 Sensor Operator

The gunship SO is gaining increasing attention because of the vital role this position assumes in identifying and targeting enemy combatants, friendly forces, as well as objects of reconnaissance and destruction. This position requires an individual to visually discriminate and synthesize various images and complex data on an electronic screen while maintaining heightened situational and spatial awareness as he/she is seated within the fuselage of the aircraft that is moving at varied speeds and directions under challenging conditions (e.g., at night, in inclement weather and hostile territory). The SO must effectively attend to the electronic video screen to calibrate instruments and distances of specific ground objects, while maintaining vigilance to visual input from electronic imagery and multiple modes of auditory input from aircrew and command. The SO must effectively communicate with aircrew to report the identification and discrimination of targets and to assist with the deployment of weapons (e.g., aligning the targeting cross-hairs on the combatant or object to be destroyed). The SO must also sustain visual targeting during and following the deployment of weapons to ensure accuracy and battle damage assessment. For the SO, this evaluation includes continual visual observation of the destruction of fixed and moving objects (such as buildings and cars), as well as the wounding and death of human combatants. The fluctuating temperature of the fuselage, due to changes in altitude and terrains, in conjunction with the shifting maneuvers of the aircraft while being required to be precise, heightens the strenuous nature of the job. The multiple and simultaneous input of visual and auditory information can increase the complexity and difficult nature of SO duties. Furthermore, the need for highly developed interpersonal and crew resource management skills is evident in the requirement to communicate effectively and relate to each crew member (e.g., pilot, co-pilot, fire control officer) under varied and demanding conditions (e.g., flying at night, in bad weather, in hostile terrain).

2.3 Personality Traits of High-Risk Operational Personnel

Military personnel are considered to be in high-demand, high-risk operational duties when they endure and face nonstandard, unconventional demands in a denied or hostile operating environment where threats to human safety, national security, foreign relations, and the consequences of mission failure are substantial. Such individuals are often involved in missions that present many unknown, unpredictable, uncontrollable events in which an individual's success in avoiding failure must often depend upon the attributes of his or her disposition (e.g., emotional resilience, confidence) and his or her unique skills from training. As a result of such conditions, military personnel and aircrew who must perform their duties under such circumstances are often considered to have unique personality traits that distinguish them from their peers in the general population. Examples of such personnel include military pilots (Ref 10,11), "special military warriors" within the U.S. Air Force Special Operations Command (Patterson JC, Brockway J, Greene C, *Evaluation of an Air Force Special Duty Assessment and Selection Program*, Conceptual Mind Works, San Antonio, TX, 2004), U.S. Army Special Forces soldiers (Ref 12,13), U.S. Navy SEALs (Ref 14), and U.S. Marine Corps Force Reconnaissance (Ref 15). These warriors are differentiated from other military personnel whose positions demand reliability and high performance but entail less risk to personal safety and less rigorous occupational challenges.

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Consequently, military psychologists working to support units with high-demand, high-risk operational personnel are often involved in assessment and selection procedures to validate the identification of personality traits that personnel should have if they are considered for such duties. Picano, Williams, and Roland (Ref 8) provide a summary of results from a variety of assessment and selection programs for military personnel in high-demand, high-risk occupations. Based on their review of published unclassified literature, psychological test information, and SME reviews, they compiled a list of attributes considered critical for successful performance. Personality traits that consistently emerged over time (from World War II to the present) and are considered relevant to performance included conscientiousness, integrity, achievement orientation, emotional stability, resilience, openness, commitment, dependability, self-confidence, self-esteem, and risk tolerance. However, the authors caution that although such traits may be considered "necessary," they are likely "insufficient" for any one occupational group because of the unique conditions and functions across different high-demand, high-risk military occupations.

Building upon the summary and review above, Chappelle et al. (see citation on page 1) conducted extensive interviews with operational AC-130 gunship SMEs (squadron commanders, high-performing incumbent SOs, and training cadre) to identify personality traits perceived as critical to training and adaptation to operational demands. They found SMEs consistently reported emotional stability, resilience/composure, self-confidence, openness/flexibility, assertiveness, success-orientation/optimism, drive, and conscientiousness to be critical to performance. SMEs also reported those who failed training appeared less disciplined, organized, and conscientious, as well as more vulnerable to emotional distress during high-demand events. SMEs consistently reported personality traits to distinguish enlisted airmen who succeed from those who fail training and advocated for personality testing as a key component to the selection of airmen considering such a profession.

2.4 Reasons for Modern Normative Data for AC-130 Gunship SOs

Although there may be controversy over specific personality traits that constitute the *right stuff*, there is little argument about deficits or conditions of pathology that represent the *wrong stuff*. For example, highly anxious, hostile, depressed, isolative, or impulsive persons conceivably elevate the risk for an aviation mishap where the threat to human life, national security, foreign relations, military operations, and loss of a multimillion dollar aircraft is already high. However, it should be mentioned there are no published studies that have experimented with allowing such individuals to fly, perhaps, in part, due to the apparent risks to personal and public safety. However, if a military or civilian psychologist discovers that a gunship SO applicant (or incumbent) is reasonably perceived to have problematic personality traits that interfere with flight safety, crew resource management, or the person's ability to effectively perform his or her duties, then the psychologist can recommend to military leadership (such as the person's commander) administrative action that may involve restriction or removal from his or her flying and aircrew duties (Ref 16).

USAF aeromedical policy requires clinical psychological assessments of military personnel and aircrew for a number of psychiatric conditions (Ref 16). An aeromedical evaluation of a person's emotional and interpersonal disposition is often required when there is a history of a developmental disorder (e.g., attention deficit and hyperactivity, learning disorder), emotional problem (e.g., depression, anxiety), or suspicion of maladaptive personality traits. In

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general, personality testing is a common part of an aeromedical evaluation when there is concern regarding an SO's psychological disposition affecting his or her ability and reliability to conduct his or her aviation-related duties. However, gunship SOs seeking waivers may be unfairly penalized if they are clinically compared with *aviator expectations* based upon data from other high-demand, high-risk military occupations that may differ from the normative data for SOs. Furthermore, it is unclear if normative data based upon the civilian, nonaircrew general population are adequate for evaluating gunship SOs. For example, what may be considered abnormal (or cause of concern) in the general population may be a common and adaptive trait of enlisted airmen who succeed as gunship SOs and vice-versa.

2.5 The Use of Personality Measures in Selecting SO Candidates for Training

The selection process of individuals into any occupation or training program can be very technical and complex. However, issues of measurement quality, as well as the accuracy and efficiency of prediction, are components of a selection system that is ultimately designed to make decisions about the assignment of people into training programs or jobs (Ref 17). Central to making these decisions is the choice of using clinical or statistical strategies (Ref 18, pp. 314-5). In a *pure clinical strategy*, data are collected and combined judgmentally. For example, interviews and observations may be conducted and results summarized in an open-ended fashion, or summarized on a standardized form using predetermined categories. In a *pure statistical strategy*, data are collected using a reliable and valid test battery (e.g., a personality inventory). Results are then compiled and individual scores may be compared to normative data to see where an individual scores relative to a meaningful sample or population norms. In both strategies, a pattern or "profile" may be developed that facilitates an informed judgment about the candidate. Further, both strategies may utilize elements of the other. That is, data collected clinically may be combined with statistical data and vice-versa. The most common strategy is the *clinical composite strategy* that combines both clinical and statistical data to develop a composite picture of the candidate to make a behavioral assessment of a candidate and how he or she compares with a specific group.

The process for selecting candidates for gunship SO training likely benefits from test scores of personality domains or facets that are known to differentiate those who are successful in training from those who fail training. This has the potential to improve the accuracy of decisions in assigning candidates to SO training. This requires setting cutoff scores on personality measures that differentiate those who pass from those who fail training. While setting cutoff scores can also be quite complex, using quantitative, judgmental, or combined methods may be best, depending on the circumstances. The *Principles for the Validation and Use of Personnel Selection Procedures* (Ref 19) note that there is no single "best" method for establishing cutoff scores.

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> If based on valid predictors demonstrating linearity or monotonicity throughout the range of prediction, cutoff scores may be set as high or as low as needed to meet requirements of the organization….Professional judgment is necessary in setting any cutoff score and typically is based on a rationale that may include such factors as estimated cost-benefit ratio, number of vacancies and selection ratio, expectancy of success versus failure, the consequences of failure on the job, performance and diversity goals of the organization, or judgments as to the knowledge, skill and ability, and other characteristics required by the work (Ref 19, pp. 46-7).

Simply stated, the utility of a selection device (e.g., ability tests or personality measures) depends on the extent to which its use improves the decisions made beyond what would have occurred had the device not been used (Ref 20). An important function of using a cutoff score is to reduce errors made in selection, i.e., minimizing incorrect acceptances and incorrect rejections. Utility is improved to the extent that decision errors are reduced. Tabulating the number of correct and incorrect decisions is appropriate in situations involving the prediction of discrete outcomes (e.g., number of successes versus failures in a training program). When measurements such as the level of performance are predicted, other approaches are appropriate.

Figure 1 illustrates a simple selection situation in which the intersection of the predictor and criterion divides individuals into four quadrants, labeled A-D. Quadrants A and C contain correct decisions. In quadrant A, individuals score above the cutoff on the predictor and would also be successful in training; hence, these are correct acceptances. In quadrant C, individuals score below the cutoff on the predictor and would be unsuccessful in training. Quadrants B and D contain incorrect selection decisions. In quadrant D, individuals score above the cutoff on the predictor yet are not successful in training. In quadrant B, individuals score below the cutoff on the predictor yet would have been successful in training.

An important goal of setting cutoff scores is to minimize incorrect decisions, i.e., reduce the proportion of individuals who scored above the cutoff on the predictor but were unsuccessful and reduce the proportion of individuals who scored below the cutoff on the predictor but would have been successful. However, raising the cutoff score (Cx) decreases the probability of incorrect acceptances, but it simultaneously increases the probability of incorrect rejections. Lowering the cutoff score (Cx) has the opposite effect. This approach, based on decision-theory, recognizes the importance of these decision errors. While both errors might be equally costly, many organizations might place different utilities on these outcomes. Is it more costly to accept an SO candidate into training who will be unsuccessful (quadrant D)? Or is it more costly to reject an SO candidate for training who would have been successful (quadrant B)? It is very costly for the Air Force to spend $1 million per candidate if that candidate is not successful. Given the high demands of the job, it is also costly to reject a candidate who would have been successful. One simple index of decision-making accuracy is the proportion of total decisions made that are correct decisions. Using the quadrants from Figure 1, the proportion of correct decisions can be determined by the formula:

$$\text{PC Total} = \frac{\mathrm{A} + \mathrm{C}}{\mathrm{A} + \mathrm{B} + \mathrm{C} + \mathrm{D}}$$

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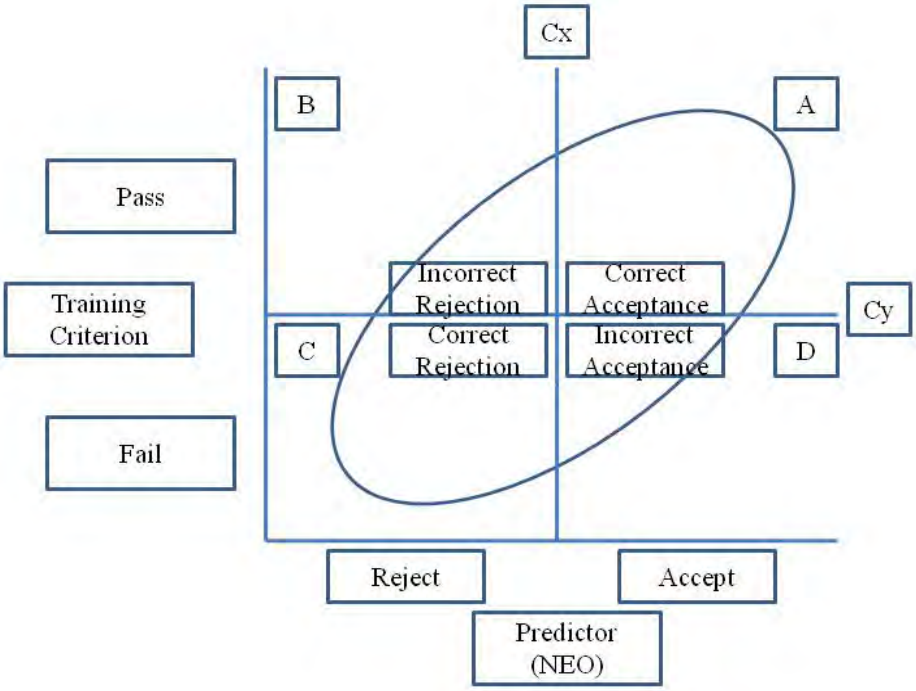

Figure 1. Selection Decisions and Training Outcomes

This formula takes into account all decisions made and weighs incorrect decisions (B and D) equally. If the organization derives no benefit from rejecting candidates, then an index of decision-making accuracy is the proportion of "accept" decisions that are correct decisions and can be determined by the formula:

$$\text{PC Acc} = \frac{\text{A}}{\text{A} + \text{D}}$$

If the organization benefits from rejecting candidates, then an index of decision-making is the proportion of "reject" candidates that are a correct decision and can be determined by the formula:

$$\text{PC Rej} = \frac{\text{C}}{\text{B} + \text{C}}$$

Generally speaking, there is no one recommended solution to setting cutoff scores when multiple predictors are used (Ref 18, pp. 318). With one predictor, the Angoff method (Ref 21) or expectancy charts are often used. The Angoff method involves the use of expert judges to rate items (i.e., test items) in terms of the probability that a minimally competent person would answer the item correctly. If the proportions are averaged for each item across judges to obtain item cutoff scores, then item cutoff scores are aggregated to obtain a test cutoff score. While this procedure is appropriate for tests that contain correct or incorrect items, it may not be appropriate for setting cutoffs on personality measures.

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Expectancy charts are more appropriate in the current context. Expectancy charts depict the likelihood that individuals will be successful on the criterion measured (i.e., pass training) for any given level on the predictor. Raw data can be used to determine the proportion of candidates who are likely to be successful, assuming the future is like the past. This can be depicted using any selection ratio, i.e., the proportion of candidates to be selected out of the pool of total candidates.

Another way to set cutoff scores in this context is to simply set the cutoff at 1 standard deviation (SD) from the mean (15th percentile or 85th percentile) of incumbents (i.e., candidates who successfully completed training). The cutoff would be established 1 SD below the mean in circumstances where a higher score is desirable (i.e., conscientiousness) and 1 SD below the mean in circumstances where a lower score is desirable (i.e., depression and openness to ideas).

In summary, personality data have the potential to benefit clinical and administrative decisions in several ways. In addition to identifying traits incompatible with a high-risk occupation, other reasons for modern normative personality data include having a clear understanding of the type of personality traits and characteristics associated with such a specialized occupational group, having a clinically relevant distribution of test scores within a group to draw from when interpreting individual scores, and being sensitive to differences between those who pass versus those who fail training.

2.6 Purpose of Study

As mentioned previously, this study has four main objectives: (a) obtain normative personality testing on SO incumbents to assess how the personality traits of such a specialized group of enlisted airmen differ from the civilian, nonaircrew general population, (b) assess how key personality traits (i.e., neuroticism, extraversion, openness, agreeableness, conscientiousness) for incumbents differ from enlisted airmen who failed training, (c) develop occupationally specific normative data and distribution of scores for use in clinical psychological aeromedical evaluations, and (d) illustrate the value of using cutoff scores on personality traits that differentiate those who pass from those who fail SO training to select future candidates that have a greater probability of success in training.

This *post-hoc* analysis will illustrate the potential value of using scores on the personality inventory in determining which airmen might be selected for training and which might be excluded from training, improving the utility of the selection decisions. At the present time, the clinical acumen and interpretation of personality testing by psychologists are limited because normative personality data do not exist. Such data are highly important to interpretation of test scores and making accurate and effective decisions in selecting candidates for SO training and during the clinical psychological aeromedical evaluations of USAF gunship SOs.

3.0 METHODS

The voluntary and informed consent of enlisted airmen who participated was obtained. The purpose and methodology of the study were reviewed and approved by the Wright-Patterson Air Force Base Institutional Review Board and assigned protocol number F-WR-2009-0027-E.

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3.1 Participants

A total of 79 USAF active duty military members volunteered to participate in the study: 59 were enlisted airmen (e.g., SO incumbents) who had successfully completed AC-130 gunship SO training (approximately 46% of the population of gunship SOs in the USAF) and 20 were enlisted airmen who had failed training (approximately 90% over a 2-year period).

3.1.1 Incumbents. Of the 59 participants who successfully completed training, 1 (1.7%) held the rank of airman basic (AB), 4 (6.8%) were airmen first class (A1C), 5 (8.5%) were senior airmen (SrA), 20 (33.9%) were staff sergeants (SSgts), 13 (22.0%) were technical sergeants (TSgts), 13 (22.0%) were master sergeants (MSgts), and 3 (5.1%) were senior master sergeants (SMSgts). This group consisted of 4 (6.8%) female and 55 (93.2%) male participants. At the time of testing, the passing group had an average age of 31.54 (SD=7.14) years. Thirty-three (56%) were married, and 26 (44%) were single. Fifty-one (86.4%) were Caucasian, 4 (6.8%) were Hispanic/Latino, 2 (3.4%) were African-American/Black, 1 (1.7%) was Asian-American/Asian, and 1 (1.7%) responded as "Other."

3.1.2 Training Failures. Of the 20 participants who failed training, 1 (5%) was an AB, 7 (35%) were A1C, 9 (45%) were SSgts, 2 (10%) were TSgts, and 1 (5%) was a MSgt. This group consisted of 2 (10%) female and 18 (90%) male participants. At the time of testing, this group had an average age of 25.75 (SD=5.20) years. Five (25%) reported their marital status as married, 5 (25%) as single, and 10 (50%) did not list a response. Eleven (55%) were Caucasian, 1 (5%) was African-American/Black, and 8 (40%) of those who failed training did not respond to this question.

3.2 Measures

The NEO PI-R measures five major personality domains and the facets or traits that underlie each domain. The five domains are as follows: (1) Neuroticism – general tendency to experience negative emotions (e.g., anxiety, anger, depression) and overall susceptibility to psychological distress; (2) Extraversion – general level of interest in social groups/events and general expressions of warmth, gregariousness, assertiveness, and positive emotion, as well as interest in excitement and group-oriented activities; (3) Openness – flexibility with thinking and behaving differently, attentiveness to inner feelings, willingness to entertain novel ideas and unconventional values; (4) Agreeableness – general interpersonal tendencies regarding altruism, trust, straightforwardness, interest in avoiding conflict, competitiveness, and tendermindedness; and (5) Conscientiousness – general level of interest in planning, organizing, carrying out tasks, self-discipline, and achievement. Each of these domains is composed of six additional facet scores. These domains and facets provide a comprehensive measurement of adult personality, with the goal of being a multipurpose personality inventory useful for predicting many criteria (Ref 22).

The inventory contains 240 statements that require subjects to respond on a Likert-type scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The reliability coefficients for the 30 facets are reported in the test manual and range from .56 to .81 (Ref 22). The normative sample, Form S for adults, served as the general population norms for this study. For

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this study, the paper and pencil version of the NEO-PI-R was used. This version is self-paced, uses a standardized set of instructions, and is scored automatically.

3.3 Procedure

USAF operational leadership within the 1st Special Operations Group was contacted regarding the purpose of the study and the need for objective personality testing from personnel within the gunship SO career field. Military leadership encouraged all available gunship SOs to participate in the testing. A list of volunteers for testing was solicited by leadership through e-mail, phone, and in-person requests. Participants were informed of the purpose of the study and that nonparticipation would not have a negative effect on their occupational prospects. They were informed individual test results were confidential and would not be included in their military medical or personnel records. They were also instructed that leadership within their chain-of-command would not have access to individual scores and their test results would remain locked within the Department of Neuropsychiatry at the USAF School of Aerospace Medicine. They were instructed on how they could obtain access to their test scores, if desired, at a later date. Volunteers were assigned to small groups of 5 to 10 participants and tested in a classroom within the 19th Special Operations training squadron facility. Participants were given the paper and pencil version of the NEO PI-R. Standardized instructions were read aloud, and consistent with the testing instructions, no time limit was established. All subjects finished testing within 1 hour.

4.0 RESULTS

Figure 2 contains box plots that depict the range and average scores for those who passed versus those who failed SO training. Raw scores were converted to T-scores for this figure. The diamond shape is the mean. The horizontal line within each box is the median. The areas within each box represent 1 SD above and below the mean.

Table 1 provides the percentile equivalent scores that correspond to the distribution of raw scores for the domain and facet dimensions of the NEO PI-R. For example, in the first row, a raw score of 25.00 for the Neuroticism domain corresponds with the 5th percentile based upon the distribution of scores for the gunship SOs.

Table 2 shows the means and standard deviations for the domain and facet scores for enlisted airmen (incumbents) who successfully passed training, those who failed training, and the civilian combined male/female adult normative sample for the NEO PI-R (Ref 22). Two tailed t-tests were conducted comparing the means of incumbent SOs to those who failed and for the civilian normative sample for each domain and facet score. For the purposes of this study, we considered differences that met the following criteria to be operationally significant: (a) the *a priori* Type I error rate was set at $p < .05$ and (b) the effect size was equal to or greater than $d = .50$ (Ref 23). Table 2 shows the T-scores, p-values, and effect sizes for these comparisons for each domain and each facet.

Two methods were used to illustrate the value of using cutoff scores on the personality measures for selection purposes. The first method set cutoff scores 1 SD above or below the mean, depending on the desired direction. The second method constructed expectancy tables for each of the three personality measures chosen for illustration.

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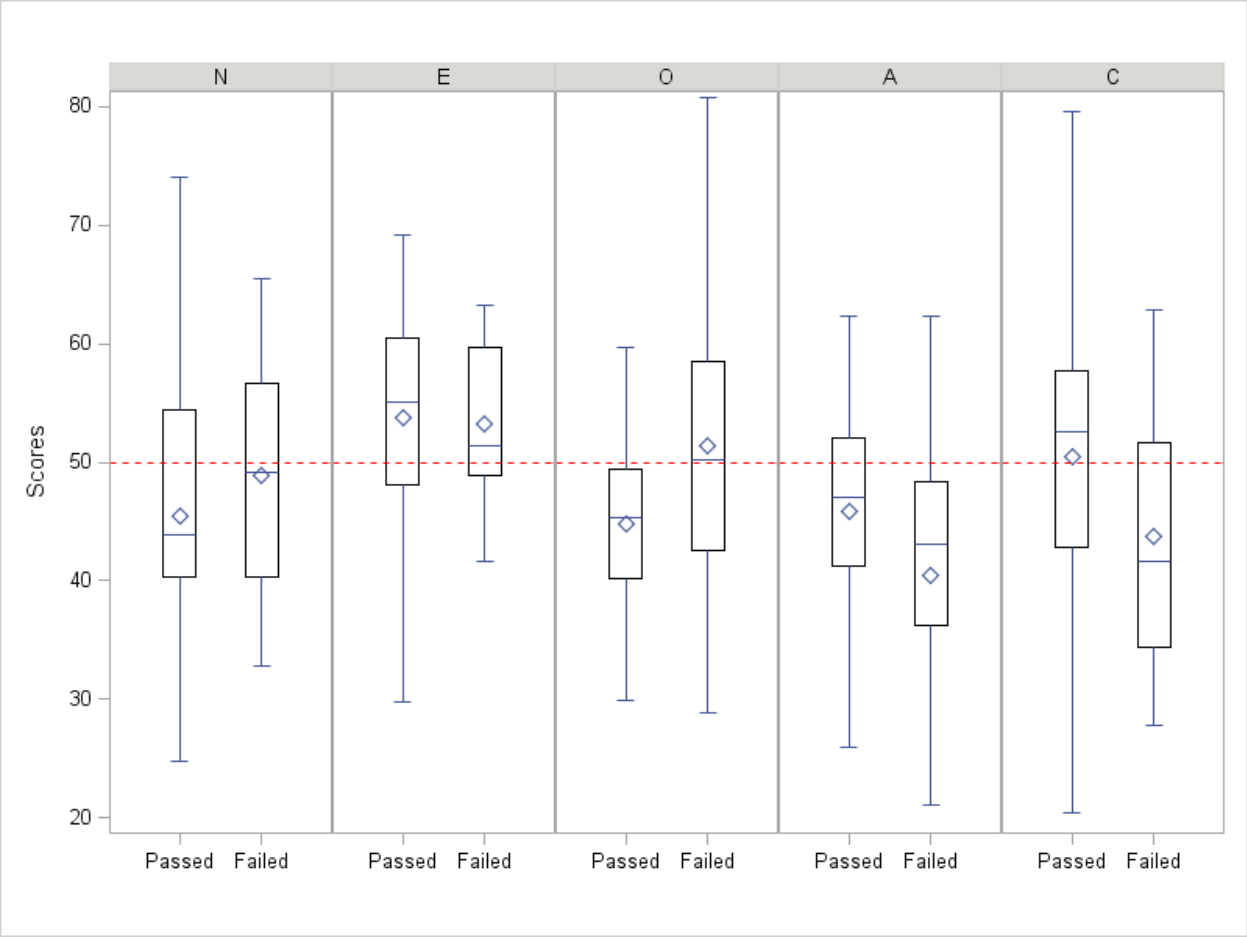

Figure 2. Box Plot of NEO PI-R Domain T-Scores for AC-130 SO Incumbents (n=59) and Those Who Failed Training (n=20) Relative to the Normative Population Sample of Adults (NEO PI-R Domain Scores: N=Neuroticism, E=Extraversion, O=Openness, A=Agreeableness, C=Conscientiousness)

Table 3 illustrates the results of setting cutoff scores for three of the personality measures using the 1 SD method. For demonstration purposes, cutoff scores were set for three different personality traits that differentiated airmen who passed SO training from those who failed SO training. These included the domain score for Conscientiousness and the facet scores for Depression and Openness to Ideas. Conscientiousness is a desirable trait, i.e., the higher the score on Conscientiousness, the greater the probability of success in training. Therefore, a cutoff score for Conscientiousness was set at approximately 1 SD below the mean (about the 15th percentile) of incumbent raw scores (mean = 123.59, SD = 20.71, cutoff = 103). Hence, an individual would need to meet or exceed the minimum standard score of 103 on Conscientiousness to be eligible for training. Depression is an undesirable trait, that is, the lower the score on Depression, the more resilient the airman is to such a negative emotion and the greater the probability of success in training. Therefore, a cutoff score for Depression was set at approximately 1 SD above the mean (about the 85th percentile) of incumbent raw scores (mean = 9.42, SD = 4.3, cutoff = 13). Hence, an individual would need to score 13 or below on

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Depression to be eligible for training. For this occupation, too much Openness to Ideas is undesirable, i.e., the lower the score on Ideas, the greater the probability of success in training. Therefore, a cutoff score for Ideas was set at approximately 1 SD above the mean (about the 85th percentile) of incumbent raw scores (mean = 18.58, SD = 4.83, cutoff = 24). Hence, an individual would need to score 24 or below on Openness to Ideas to be eligible for training. Table 3 shows the number and percentage of incumbents (i.e., passed training) and training failures who would have been retained (i.e., selected for training) and eliminated (i.e., not selected for training) for each of these three personality traits, if they had been used in the process to select candidates for SO training. For example, using a cutoff score of 24 for Openness to Ideas, 55 of the 59 incumbents (93%) would still have been retained, that is, selected to enter SO training. In contrast, 9 of the 20 (45%) training failures would have been eliminated, that is, not selected for training.

Table 3 shows that setting minimum raw cutoff scores will help to reduce the number of candidates selected for training who would have failed. As mentioned previously, there is an estimated cost of $1 million to train each candidate over a year period in becoming a fully operational SO, although the cost of setting cutoff scores is the potential of rejecting candidates who would have passed. However, in this case, selecting out those who would have failed is more important in terms of saving time, money, and other resources.

By setting a cutoff score of 24 on the facet score for Openness to Ideas, almost 50% of those who failed would have been eliminated during the selection process, yielding a potential savings of $9 million. The cost of this decision, according to Table 3, is at the expense of not selecting four candidates who would have passed. However, if the goal is to reduce training attrition and training costs, this appears to be a reasonable expense at the front end.

Tables 4, 5, and 6 contain data that compare those who passed versus those who failed SO training using different cutoff scores for each of the three variables of Conscientiousness, Depression, and Openness to Ideas, respectively. Each table compares the percentage of personnel who would not have been selected for training had these different cutoff scores been used. Because no data are available on the proportion of candidates accepted/rejected during the actual selection process, any forecasting makes the assumption that the profile of future candidates will be similar to the profile of the 79 candidates in this study.

5.0 DISCUSSION

5.1 Incumbents vs. General Population

The first objective of this study was to obtain normative personality testing on SO incumbents to assess how the personality traits of such a specialized group of enlisted airmen differ from the civilian general population.

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Table 1. Distribution of Gunship SO Incumbent Raw Scores According to Specific Percentiles

Domain & Facet	Raw Scores Corresponding to Specific Percentiles of—						
	5th	10th	25th	50th	75th	90th	95th
Neuroticism	25.00	46.00	56.00	63.00	85.00	95.00	101.00
Anxiety	2.00	5.00	9.00	11.00	14.00	16.00	20.00
Anger	4.00	8.00	10.00	12.00	16.00	19.00	21.00
Depression	2.00	3.00	7.00	10.00	12.00	15.00	18.00
Self-Consciousness	6.00	8.00	9.00	12.00	16.00	18.00	19.00
Impulsivity	5.00	9.00	11.00	14.00	18.00	20.00	22.00
Vulnerability	1.00	2.00	5.00	8.00	10.00	12.00	15.00
Extraversion	81.00	97.00	105.00	118.00	129.00	137.00	139.00
Warmth	15.00	17.00	20.00	23.00	24.00	26.00	27.00
Gregariousness	9.00	12.00	16.00	20.00	22.00	24.00	25.00
Assertiveness	9.00	13.00	16.00	18.00	21.00	24.00	27.00
Activity	11.00	13.00	16.00	18.00	21.00	24.00	24.00
Excitement-Seeking	14.00	16.00	19.00	21.00	24.00	26.00	27.00
Positive-Emotion	11.00	13.00	16.00	18.00	21.00	24.00	24.00
Openness	76.00	79.00	93.00	103.00	110.00	118.00	127.00
Fantasy	7.00	10.00	12.00	15.00	19.00	22.00	23.00
Aesthetics	5.00	7.00	10.00	14.00	16.00	19.00	20.00
Feelings	11.00	14.00	16.00	19.00	21.00	23.00	24.00
Actions	11.00	11.00	14.00	16.00	18.00	20.00	21.00
Ideas	10.00	11.00	15.00	19.00	22.00	24.00	26.00
Values	13.00	15.00	18.00	20.00	21.00	23.00	26.00
Agreeableness	79.00	92.00	108.00	116.00	124.00	131.00	137.00
Trusting	8.00	13.00	16.00	20.00	23.00	24.00	28.00
Straightforwardness	14.00	15.00	17.00	19.00	23.00	24.00	25.00
Altruism	16.00	18.00	20.00	23.00	25.00	27.00	28.00
Compliance	10.00	11.00	14.00	16.00	18.00	20.00	21.00
Modesty	9.00	13.00	16.00	18.00	21.00	23.00	24.00
Tendermindedness	10.00	14.00	17.00	19.00	21.00	22.00	23.00
Conscientiousness	84.00	93.00	111.00	126.00	136.00	148.00	160.00
Competence	16.00	18.00	20.00	23.00	25.00	28.00	30.00
Orderliness	9.00	13.00	16.00	18.00	21.00	24.00	26.00
Dutifulness	17.00	18.00	20.00	23.00	25.00	27.00	28.00
Achievement-Striving	12.00	15.00	18.00	21.00	23.00	26.00	27.00
Self-Discipline	13.00	16.00	19.00	23.00	24.00	27.00	30.00
Deliberation	11.00	12.00	14.00	17.00	20.00	23.00	26.00

Note: This table provides a psychologist with the capability of comparing an individual SO applicant's (or incumbent's) NEO PI-R domain and facet scores with the grouped distribution of enlisted airmen who successfully pass training to assess for differences.

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Table 2. Descriptive Statistics and Comparisons of SO Incumbents to Training Failures and the General Population[a]

Domain & Facet	Incumbents (n=59)		Training Failures (n=20)		Incumbents vs. Training Failures			General Population (n=1000)		Incumbents vs. General Population Norms		
	Mean	SD	Mean	SD	T-score	p-value	Effect	Mean	SD	T-score	p-value	Effect
Neuroticism	67.41	21.42	74.75	18.73	-1.32	-.19	-.33	79.10	21.20	-4.08	.00	**-.55**[b]
Anxiety	11.02	4.22	12.90	4.23	-1.72	.09	**-.44**	14.30	5.30	-5.71	.00	**-.68**[b]
Anger	12.76	4.82	12.55	4.21	0.19	.85	.05	12.40	4.60	0.56	.58	.08
Depression	9.42	4.32	12.15	4.87	-2.22	.03	**-.59**[b]	12.30	5.40	-4.90	.00	**-.59**[b]
Self-Consciousness	12.44	4.09	13.35	4.61	-0.78	.44	-.21	14.30	4.40	-3.38	.00	-.44
Impulsiveness	13.95	4.69	15.15	4.20	-1.07	.29	-.27	15.80	4.40	-2.95	.00	-.41
Vulnerability	7.81	3.90	8.45	2.74	-0.80	.43	-.19	10.00	3.90	-4.19	.00	**-.56**[b]
Extraversion	115.58	17.16	114.15	13.08	0.39	.70	.09	109.40	18.40	2.68	.00	.35
Warmth	22.15	3.52	20.75	3.85	1.44	.15	.38	22.90	4.00	-1.58	.12	-.20
Gregariousness	18.48	4.72	17.90	4.60	0.48	.63	.12	16.50	4.80	3.13	.00	.42
Assertiveness	18.20	4.60	17.55	3.75	0.63	.53	.16	15.80	4.70	3.89	.00	**.52**[b]
Activity	18.12	3.75	17.85	3.53	0.29	.77	.07	17.60	4.40	1.02	.31	.13
Excitement-Seeking	21.20	3.88	21.65	4.16	-0.42	.67	-.11	16.40	4.90	9.08	.00	**1.09**[b]
Positive-Emotion	18.10	3.90	18.90	3.43	-0.87	.39	-.22	20.20	4.50	-3.98	.00	**-.50**[b]
Openness	101.59	13.75	112.30	22.36	-2.02	.05	**-.58**[b]	110.60	17.30	-4.81	.00	**-.58**[b]
Fantasy	15.44	4.94	18.25	5.25	-2.10	.04	**-.55**[b]	16.60	4.90	-1.75	.08	-.24
Aesthetics	13.46	4.68	15.55	6.42	-1.34	.18	-.37	17.60	5.30	-6.55	.00	**-.83**[b]
Feelings	18.64	3.50	19.25	4.33	-0.57	.57	-.15	20.30	4.00	-3.51	.00	-.44
Actions	15.80	2.86	16.05	3.73	-0.28	.79	-.08	16.40	3.70	-1.54	.12	-.18
Ideas	18.58	4.83	23.25	5.45	-3.41	.00	**-.91**[b]	19.00	5.00	-0.65	.52	-.09
Values	19.68	3.34	20.00	4.12	-0.32	.75	-.09	20.70	4.10	-2.25	.02	-.27
Agreeableness	113.97	16.42	105.80	21.70	1.54	.13	.42	124.30	15.80	-4.71	.00	**-.64**[b]
Trusting	19.12	5.27	17.45	5.17	1.24	.22	.32	21.30	4.20	-3.12	.00	-.46
Straightforwardness	19.76	3.74	17.10	5.54	2.00	.05	**.56**[b]	21.20	4.40	-2.84	.00	-.35
Altruism	22.51	3.87	21.60	3.83	0.91	.36	.24	23.60	3.50	-2.11	.03	-.30
Compliance	15.88	3.29	14.90	4.36	0.92	.36	.25	18.90	4.00	-6.76	.00	**-.82**[b]
Modesty	18.02	3.83	17.15	3.33	0.97	.34	.24	18.90	4.20	-1.71	.09	-.22
Tendermindedness	18.68	3.45	17.85	4.76	0.72	.48	.20	20.50	3.50	-3.93	.00	**-.52**[b]
Conscientiousness	123.59	20.71	112.40	18.04	2.31	.02	**.58**[b]	123.10	17.60	0.18	.86	.03
Competence	22.76	3.77	20.90	3.39	2.06	.04	**.52**[b]	22.20	3.50	1.11	.27	.15
Orderliness	18.36	4.33	15.65	3.30	2.92	.00	**.70**[b]	19.00	4.20	-1.11	.27	-.15
Dutifulness	22.73	3.46	20.95	3.47	1.98	.05	**.51**[b]	23.20	3.90	-1.01	.31	-.13
Achievement-Striving	20.42	4.38	18.95	3.61	1.49	.14	.37	19.50	4.00	1.58	.12	.22
Self-Discipline	21.76	4.64	19.85	3.23	1.77	.08	.44	21.80	4.30	-0.06	.95	-.01
Deliberation	17.56	4.17	16.10	4.56	1.26	.21	.33	17.50	4.10	0.11	.91	.01

[a]Adapted and reproduced by special permission of the publisher Psychological Assessment Resources, Inc., 16204 No. Florida Ave, Lutz, FL 33549 (from Ref Costa & McCrae).
[b]Identifies scores that are considered to be clinically meaningful based upon a significant t-test with moderate to large effect size.

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Table 3. Illustration of Using Minimum Raw Cutoff Scores for Three Personality Traits

Personality Trait	Raw Score	Candidates Selected for Training Who—			
		Passed		Failed	
		# Retained	% Retained	# Eliminated	% Eliminated
Conscientiousness	103	51	86	6	30
Depression	13	51	86	10	50
Openness to Ideas	24	55	93	9	45

Table 4. Percentage of Candidates Who Passed vs. Failed Who Would Have Been Rejected for Entry into SO Training Using Different Cutoff Scores on Conscientiousness

Raw Cutoff Score	Candidates Selected for Training Who—	
	Passed (% Rejected)	Failed (% Rejected)
70	0	0
80	5	0
90	8	15
100	14	30
110	24	50
120	37	60

Table 5. Percentage of Candidates Who Passed vs. Failed Who Would Have Been Rejected for Entry into SO Training Using Different Cutoff Scores on Depression

Raw Cutoff Score	Candidates Selected for Training Who—	
	Passed (% Rejected)	Failed (% Rejected)
20	3	0
18	3	15
16	5	35
14	12	50
12	19	55
10	37	65

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Table 6. Percentage of Candidates Who Passed vs. Failed Who Would Have Been Rejected for Entry into SO Training Using Different Cutoff Scores on Openness to Ideas

Raw Cutoff Score	Candidates Selected for Training Who—	
	Passed (% Rejected)	Failed (% Rejected)
30	0	10
28	0	20
26	3	35
24	7	45
22	20	50

The test scores from the NEO PI-R indicate that, as a group, enlisted airmen who passed SO training are different from those in the general population on domain and/or facet scores for four out of five of the major NEO PI-R personality constructs (i.e., Neuroticism, Extraversion, Openness, and Agreeableness). As a group, personality testing and data analyses from Tables 1 and 2 reveal gunship SO incumbents are more resilient and less vulnerable to experiencing emotional distress (e.g., anxiety and depression). They are more likely to be assertive and expressive of positive emotions and much more likely to engage in action-oriented, excitement-seeking activities. They are also less open to imagination, aesthetics, (e.g., expressive arts), inner feelings, and novel ways of behaving. In general, they are less trusting, less sympathetic of others, and more skeptical of others' intentions. They are also more competitive and willing to pursue self-interests. It is important to note that in comparison to the general population, SO incumbents were similar on the domain and facet scores assessing conscientiousness. They are similar in terms of self-discipline, orderliness, planning (i.e., deliberation), achievement-striving, sense of duty, as well as sense of self-efficacy and competence.

5.2 Incumbents vs. Training Failures

The second objective of this study was to assess how key personality traits (e.g., Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness) for incumbents differ from enlisted airmen who failed SO training.

For the most part, SO incumbents were similar to enlisted airmen who failed training. There were no significant differences on the majority of domain and facet subtests. However, as revealed by Table 2, there are notable differences on the Openness and Conscientiousness domains and on some of the facet subtests within such domains. There were also notable differences on the Depression facet within the Neuroticism domain and Straightforwardness and Tendermindedness facets within the Agreeableness domain. As a result (and according to Table 2), incumbents as a group (when compared with those who failed training) appear less willing to entertain and act upon novel ideas and unconventional values; less focused on their inner emotions; and less likely to be interested in an active, inner, fantasy life, and prefer to focus on the task at hand. They are more likely to be frank about their thoughts and opinions. They are less likely to experience feelings of sadness, discouragement, and worry. They have a higher sense of self-efficacy and sense of competence, are more organized and orderly, and have a clearer sense of ethical principles and conscience.

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Some of the personality differences between those who passed versus failed SO training provide insight into key personality traits that may influence training outcomes. First, those who failed training reported being less conscientious than those who passed training. According to SO SMEs, self-discipline, orderliness, and general conscientiousness are personality traits considered critical to SO training and operational performance (see citation on page 1 for Chappelle et al., 2009). It is also important to note that such characteristics are also considered key to successful performance across a wide range of civilian and military occupations (Ref 7). Second, the training program and operational demands of gunship SO duties are described as very intense and rigorous, and it has been reported by gunship SO SMEs (e.g., training cadre) that enlisted airmen who struggle with self-confidence, a sense of self-efficacy, and organization are at higher risk of failure (see citation on page 1 for Chappelle et al., 2009). The results of this study support such SME perceptions and revealed several of those who failed training had lower scores in such areas. Third, gunship SO training and duties can be stressful given the intensity of training and operational missions, especially during the surveillance and deployment of weapons to destroy enemy combatants and targets in theaters of conflict. SMEs have reported those who fail training appear more "emotional," i.e., prone to being more worried and discouraged. The results of this study support such perceptions held by SMEs and revealed that enlisted airmen who failed training, as a group, are more likely to experience negative emotions (i.e., symptoms of fear, tension, and discouragement) under highly stressful circumstances. Lastly, it has been reported by SMEs that gunship SOs must be focused on completing tasks in a conventional fashion in accordance with the standardized procedures established in training and various aerial exercises. Staying focused on standardized procedures and protocol can be especially difficult during long periods of monotony or high stress (see citation on page 1 for Chappelle et al., 2009). The results of this study revealed that enlisted airmen who failed training have an active inner fantasy life and prefer to entertain and act upon unconventional ways of thinking about events, which may hinder focus and adherence to conventional standards and procedures.

Despite the personality differences between those who passed versus failed training, it is important to note that training performance is affected by several factors, such as the training curriculum, length of training, styles of learning, teaching methodologies and strategies, as well as the interpersonal disposition and rating procedures of individual instructors. As a result, the findings above regarding personality differences between the two groups cannot conclusively distinguish those who pass from those who fail training. Nonetheless, the above differences between those who passed versus failed training help to shed light on personality traits that influence performance and adaptation to the operational environment.

5.3 Consideration of Cutoff Scores

The third purpose of this study was to consider cutoff test scores to improve the selection of training candidates who have a high likelihood of successfully passing training.

The selection of candidates for entry into gunship SO training is an important process to ensure the best qualified individuals are selected for training, while those less likely to be successful are selected out. Three personality measures that statistically differentiated those who passed from those who failed training were chosen to illustrate how such data can be useful to decision-makers. As mentioned previously, those who passed SO training scored higher on the domain of Conscientiousness and lower on the facets of Depression and Openness to Ideas compared to those who failed SO training. The results from Tables 3-6 illustrate the utility of

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using statistical data from these three personality measures to aid decision-makers in admitting candidates to the SO training pipeline. An important goal of setting cutoff scores is to reduce the proportion of individuals who scored above the cutoff on the personality measures who were unsuccessful and to reduce the proportion of individuals who scored below the cutoff on the personality measures who would have been successful. While setting cutoff scores is not an exact science, setting them 1 SD above or below the mean of the group who passed training is a rational approach that produces quite reasonable results. For example, a cutoff raw score of 24 on Openness to Ideas is approximately 1 SD above the mean of the passing group. For this sample, this cutoff would have retained 93% of those who scored at or below the cutoff and ultimately passed SO training. This cutoff would have also eliminated (i.e., selected out) 45% of those who scored above the cutoff and ultimately failed SO training. At a cost of $1 million for training each individual, this would have saved approximately $9 million in SO training costs for those nine individuals. Tables 3-6 illustrate the results of using cutoffs at different intervals on the personality measures. These data provide more detailed information for decision-makers to assist in using these data for select in and select out decisions.

It is important to remember that changing the cutoff score for more rigorous selection decreases the probability of incorrectly selecting candidates who would fail, but it simultaneously increases the probability of incorrectly rejecting those who would pass training. Changing the cutoff score for less rigorous selection has the opposite effect. Thus, it is vital to recognize the importance of these decision errors. While both errors might be equally costly, some organizations might place different values on these errors. In regards to selecting USAF aircrew, it is very costly to accept a gunship SO candidate into training who will be unsuccessful. Therefore, it is reasonably perceived to set cutoffs that minimize the acceptance of those who are more likely to be unsuccessful at the expense of rejecting a gunship SO candidate for training who may have been successful. It is clear that this quantitative approach can be combined with clinical data from interviews and observations to develop a composite picture of the candidate to make a more accurate assessment and prediction of candidate suitability for SO training. This *clinical composite strategy* can result in significant cost savings and, overall, a better investment in human resources.

However, due to the potential complexity of using cutoff scores in selection, as well as legal and psychometric issues, Cascio and Aguinis (Ref 24) suggest the following: (a) determine if it is necessary to set cutoff scores because legal and professional guidelines do not require their use; (b) consider the notion that there is not a single “best” method of setting cutoff scores for all situations; (c) begin with a job analysis that identifies levels of proficiency on critical knowledge, skills, abilities and other characteristics to identify traits for setting cutoff scores; (d) if a cutoff score is to be used as an indicator of minimum proficiency, relating it to what is necessary on the job is essential; (e) consider how statistical issues (standard error of measurement) and procedures influence the setting of cutoff scores; (i) consider the legal issues (adverse impact) when setting cutoff scores; and, finally, (j) set cutoff scores high enough to ensure that minimum standards of performance are met.

5.4 Aeromedical Application and Clinical Vignette

The fourth objective of this study was to develop occupationally specific normative data and distribution of personality scores for use in clinical psychological aeromedical evaluations.

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Interpretation of personality testing involves the use of normative data and pattern analysis of test scores. Through the use of normative data it is possible to gauge the degree of an individual's specific traits as compared with peers (whether in the general population or a specific occupation). Furthermore, pattern analysis of test scores involves examining the person's scores to develop an overall profile of a person's personality (e.g., emotional-interpersonal disposition) and whether a person is suited to various settings and situations. For example, if an AC-130 gunship SO applicant's scores on personality testing reveal (when compared with incumbents) someone who prefers to be very isolative and withdrawn, has very low self-esteem, and is highly interpersonally hypersensitive, then there would be reason to suspect the person's psychological disposition may be incompatible with the socially demanding nature of gunship SO duties during training and operational missions, especially if the candidate's scores are above or below certain cutoff thresholds for personality traits that distinguish those who fail from those who succeed in training, as in Table 3. Another example is when an incumbent has been disqualified from flying due to a history of emotional and interpersonal problems. If the incumbent's test scores reflect the absence of emotional difficulties and the presence of a high level of stress resilience and interpersonal functioning (and is within normal limits when compared with other gunship SOs), then there may be reason to conclude the person could return to his or her flying duties.

Although general population norms can be helpful in distinguishing how a person's personality traits compare with peers in the general population, it does not allow for determining how a person compares with SO incumbents. For example, a gunship SO recovering from depression may show a general pattern of average stress tolerance scores vis-à-vis the general population, but these scores may be well below normal limits for gunship SO norms. Therefore, it is important to utilize Table 1 (distribution of occupationally specific gunship SO normative test scores) in this study when clinically evaluating and interpreting the scores of a gunship SO incumbent or applicant. The percentile tables allow a clinical psychologist to determine how a specific score compares with the distribution of scores for gunship SO incumbents as a group. In general, scores that fall above the 90th or below the 10th percentile can be viewed as outliers and significantly different from most others.

The utility of these data is illustrated by the case of a 22-yr-old, male, senior airman in the logistics squadron who was applying to cross-train into the AC-130 gunship SO career field. The airman had recently recovered from a significant history of depression 12 mo earlier. In this case, he reported experiencing clinical depression following a series of unfortunate life stressors. He reported being treated for 6 mo of weekly to bi-weekly sessions of cognitive behavioral therapy by the installation's psychologist. However, his history of depression disqualifies him from cross-training into an enlisted aircrew position according to USAF aeromedical policy (Ref 16). Prior to entering the training pipeline, he needed an evaluation to determine if his history of depression was fully resolved and if he met the aeromedical waiver criteria, which are significantly higher than general medical fitness standards for service in the military. Following treatment, he was referred to the installation's active duty psychologist for an evaluation. The psychologist who evaluated the gunship SO training applicant included personality testing (i.e., NEO PI-R) as part of a comprehensive clinical psychological evaluation.

Based upon the airman's responses to items on the NEO PI-R, the psychologist reported his scores (when compared with peers in the civilian, nonaircrew normative sample) to be within normal limits. However, it would have been incorrect to conclude his scores were within normal limits for AC-130 gunship SOs. According to the data from Table 1, when compared with

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gunship SOs, his vulnerability to emotional distress (Neuroticism raw score = 94), anxiety (raw score = 16), and depression (raw score = 15) was very high and in the 90th percentile. The ability to maintain composure and emotional resilience are considered key attributes for those who pass gunship SO training and adapt to operational demands (see citation on page 1 for Chappelle et al., 2009). However, such scores revealed, when compared with those who pass training, he is not as emotionally resilient.

Furthermore, his scores assessing assertiveness (raw score = 13) and propensity for adventure and engaging in excitement-seeking activities (raw score = 16) were well below normal limits and in the 10th percentile. As mentioned previously, high levels of assertiveness and propensity to engage in excitement-seeking activities are attributes perceived by SMEs to be critical to training and operational performance (see citation on page 1 for Chappelle et al., 2009).

In addition, his scores were compared to those who failed training. His raw score assessing his propensity to pursue new and unconventional and imaginative ideas (raw score = 27) was very high and above the 99th percentile. This trait can be considered an adaptive and well-desired trait in many situations. However, as revealed in Table 2, a high level of this trait was a key attribute that distinguished those who failed training. High levels of this trait is likely maladaptive to training and performance for this career field. Furthermore, his scores assessing his overall conscientiousness (raw score = 93) were well below normal limits at (or below) the 10th percentile for gunship SO incumbents and the general population. This is another key trait that distinguished those who passed from those who failed training and is considered highly predictive of performance across a wide range of military and civilian occupations (Ref 7). As a result, his recent history of depression and current pattern of his test scores were perceived as problematic for adapting to the rigors of gunship SO training.

Equally as important to comparing his scores to occupationally specific norms is comparing his current scores to baseline information (obtained from the applicant and third party reports, such as family members and leadership in his chain-of-command) regarding his functioning prior to his history of depression. It was discovered through such reports from the applicant and others that his psychological disposition was in a much higher range of adaptive functioning and likely at the higher end of the average range when compared with gunship SO incumbents. This finding (along with his test scores above) suggested his emotional-interpersonal disposition had not fully returned to baseline, and he was perhaps still experiencing symptoms of depression.

After reviewing additional information, the psychologist concluded the applicant's current state of adaptive functioning had not returned to baseline and test scores regarding personality traits perceived critical to performance by SMEs were considered to elevate his risk for failure; thereby, he was not compatible with the challenging and dangerous conditions associated with operations of the gunship. As a result, it was believed he could continue to benefit from additional mental health therapy prior to applying for such a high-demand, high-risk career field. The normative data included in Table 1 helped the psychologist to accurately interpret the applicant's test scores in comparison to gunship SO incumbents as a group and to render a difficult and very important decision about his readiness to enter a high-demand, high-risk occupation. It is clear that occupationally specific normative data are needed to effectively evaluate gunship SO applicants and incumbents when rendering aeromedical decisions.

There are significant group differences between the AC-130 SO incumbent normative scores from those who failed training and those utilized in the NEO PI-R civilian, nonaircrew

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general population normative sample. As a result, psychologists should be sensitive to such differences and utilize normative data that more accurately represent the group with which a person is being compared. Otherwise, as in the case illustrated above, a psychologist may mistakenly conclude that a gunship SO candidate's or incumbent's scores are within normal limits and adaptive to such a platform when, in fact, the scores are not when compared with occupationally specific norms (i.e., norms for AC-130 SO incumbents).

5.5 Limitations to the Study

Although the sample size is small, this study used almost half of the current population of USAF AC-130 gunship SO incumbents. However, there are several limitations. First, the lack of fully developed validity scales within the NEO PI-R makes it difficult to assess the degree of impression management participants engaged in while completing the test. An alternative personality test measuring similar traits with well-developed validity scales would help to reveal the degree of impression management influencing the results of those who passed as well as failed training. Second, generalizing the results of this study to incumbents in other high-demand occupations (such as SOs operating remotely piloted aircraft) may not be appropriate. The selection processes, duties, and aviation-related missions differ significantly. Third, personality descriptions are based on the averages of all SO incumbents included in this study; hence, caution should be used regarding interpretation of test scores because individual characteristics can vary widely. Fourth, it is unknown whether there are existing cohort differences related to time of training and, if there are such effects, how they impact study results. For example, it is unclear whether there are substantial personality differences between those who entered and succeeded in SO training 10 years ago versus those who more recently entered training. Fifth, individual assessments of gunship SO applicants (or incumbents) should include information from other sources (e.g., spouse, military commander, and supervisor) and clinical interviews to supplement personality test scores. Sixth, the use of cutoff scores in this study is for illustration purposes only. More data are needed to increase the reliability of the data and the confidence in the cutoff scores used. Finally, the civilian, normative sample of the NEO PI-R used for this study is based on U.S. census data projected for 1995 and may not be representative of the current general population. This further supports the need for up-to-date, occupation-specific normative data for comparison purposes when interpreting gunship SO applicant (or incumbent) scores on the NEO PI-R.

6.0 CONCLUSION

A valid psychological assessment is a crucial part of the selection and aeromedical waiver process for USAF aircrew in unique and high-risk positions, such as AC-130 gunship SOs. In addition to ability and motivational factors, personality characteristics play a key role in success as a gunship SO. The results of this study provide psychologists with valuable clinical information that identifies traits that differentiate AC-130 gunship SOs who passed training from those who failed training across several personality domains and facets. This helps to inform selection decision-makers about the domains and facets of personality testing that may increase the prediction of training performance outcomes and, hence, be used in the selection process prior to training. Finally, normative data are invaluable to military health providers (e.g., flight medicine physicians and operational psychologists) in making informed decisions and

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recommendations regarding the clinical psychological fitness of airmen to perform such aviation-related duties.

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LIST OF ABBREVIATIONS AND ACRONYMS

A1C	airman first class
AB	airman basic
DoD	Department of Defense
MSgt	master sergeant
NEO PI-R	NEO Personality Inventory-Revised
SD	standard deviation
SME	subject matter expert
SMSgt	senior master sergeant
SO	sensor operator
SrA	senior airman
SSgt	staff sergeant
TSgt	technical sergeant
USAF	United States Air Force

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